EMERGENCY SERVICES DIVISION PROCEDURE

Procedure No. FR-SCBA-9.0.5

Revision No. 1

BROOKHAVEN NATIONAL LABORATORY

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HIGH PRESSURE HYDRO-TESTING COMPOSITE CYLINDERS

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- 1.1 Composite cylinders manufactured in accordance with DOT Exemption E7235 are to be hydrostatically tested every three years.
- 1.2 This Standard Operating Procedure applies to high pressure hydro-test procedures for SCBA cylinders (Hoop wrapped, high pressure composite, DOT-E-7235 and Dot-E-8059, fully wrapped cylinder).

2.0 RESPONSIBILITIES

2.1 The Fire/Rescue Group has the responsibility to hydro-statically test SCBA cylinders to the requirements of the specific exemptions and or specifications.

3.0 <u>DEFINITIONS</u>

None.

4.0 PREREQUISITES

None.

5.0 PRECAUTIONS

None.

6.0 PROCEDURE

- 6.1 Place cylinder in holding fixture so that cylinder fiber windings are not damaged. Use air operated vise with composition holding device located in recharge room.
- 6.2 Slowly open valve and vent cylinder.
- 6.3 Remove valve from cylinder using wrench. Inspect threads of valve and cylinder for damage.
- 6.4 <u>Exterior Inspection</u> Cylinder should be clean and all attachments should be removed that will interfere with visual inspection. Inspect for damage. Refer to CGA Pamphlet C-6.2, "Guidelines for Visual Inspection of Fiber Reinforced High Pressure Cylinders".
- 6.5 <u>Interior Inspection</u> Interior should be inspected according to CGA Pamphlet C-6.1, Standard for Visual Inspection of High Pressure Aluminum Compressed Gas Cylinders.
- 6.6 <u>Hydrostatic Test Procedure</u> (Reference CGA Pamphlet C-1) "Methods for Hydrostatic Testing of Compressed Gas Cylinders".
 - 6.6.1 Verify test equipment for calibration. Using the calibrated cylinder, test to 8,000 PSI. Expansion ratio

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shall be 102.0 and permanent expansion ratio 0.

- 6.6.2 Fill SCBA cylinder with clean water. Temperature should be the same as in water jacket.
- 6.6.3 Install test adapter to water filled cylinder to be tested. Hand tighten or use small wrench. Do not tighten so as to crush O ring on test adapter.
- 6.6.4 Attach cylinder to be tested to the quick connect fitting of the lid.
- 6.6.5 Using the hoist lower the lid with attached cylinder into the water jacket, positioning the lid so the high pressure connection is accessible to the high pressure line. Secure the water jacket lid by uniformly tightening the hand clamps.
- 6.6.6 Open valve to burette to be used (50 cc). Close all other burette valves. Open bleed valve on water jacket lid flange. Open valve "A" on console allowing water to "top off" water jacket bleeding air from jacket and line to burette. As water rises in burette close console valve "A" and the jacket valve, after observing air and water exiting from valve. Leave the one burette valve in use open.
- 6.6.7 Zero Burette The indicator marker crossing the burette at eye level is the "reference point" at which all expansion readings are taken. The vertical distance from this reference point, downward to top flange of water jacket should not be altered as calibrated cylinder readings can be affected. Move the burette board up (or down) until the "O" cc mark of the lower end of the burette in use is positioned at the reference point line up with the indicator marker. Open the burette manifold drain valve allowing the water level to drop. Close the drain valve when the water level (bottom of meniscus) in the burette lines up with "O" cc. Mark on burette and reference marker.
- 6.6.8 Bleed Cylinder Connect the high pressure flexible line at the line quick coupler located on top of the jacket lid. The line pushes in and clicks to lock (to disengage line pull back on coupler sleeve and pull line out of coupler). Do not handle coupler when under pressure. Open bleed valve E (uppermost valve on water jacket lid). Crack water valve "B" on console and continue water flow until air free water exits from the bleed valve. Close bleed valve and open valve "B" at least one full turn.
- 6.6.9 Pump to Test Pressure slowly in increments of 120 lbs. per second (for a 4500 lb. rated cylinder pressure, 7500 lbs. test pressure, up to 5/3 cylinder rated pressure). Open valve "C" on console to activate pump. Pumping speed is adjusted by controlling valve "C". When test pressure of 7500 lbs. is reached, close air to pump valve "C" to reach test pressure in about a minute.
- 6.6.10 Record Expansions Hold at test pressure for at least one minute. Lower the burette assembly so that the water level (bottom of meniscus) is even with the reference marker. Observe and record the result (total expansion in cubic centimeters).
 - 6.6.10.1 Close water valve "B" on console.
 - 6.6.10.2 Slowly crack bleed valve on lid jacket bleeding off pressure from the cylinder until pressure gauge shows a zero pressure reading.
 - 6.6.10.3 Raise the burette assembly unit until a new water level in burette is at the reference marker level. Observe and record reading (permanent expansion in cc).

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6.7 <u>Calculations</u>

You have both total and permanent expansion readings of a given test pressure.

- 6.7.1 Example: If total expansion was 52 cc, permanent expansion was 2 cc then 2 cc/52 x 100 = 3.8%. Allowable % ratio is 5% hence cylinder passed test.
- 6.8 Disengage water jacket lid, remove cylinder. Place in vise, remove lid and adapter. Dump out water.
- 6.9 Hydro-test dates must be stamped into the metal of the cylinder shoulder near the original test date. Fully wrapped cylinders will have the hydro-testers decal affixed to the cylinder.
- 6.10 Place cylinder on drying rack. When inside of cylinder is dry, reinstall valve and refill cylinder (See SOP FR-1.3.4).

7.0 <u>REFERENCES</u>

- 7.1 Compressed Gas Association Pamphlet C-1
- 7.2 Compressed Gas Association Pamphlet C-6.1, C-6.2

8.0 <u>ATTACHMENTS</u>

None

9.0 **DOCUMENTATION**

9.1 Hydro-test results entered on Hydro-Test Record Form and kept for three years or next hydro-test (which ever comes first).